IC 5.7 Review Exercises
WDTB Distance Learning Operations Course
Fall 2003

Part I. Sounding Parameter Matching (from Lesson 2 in Student Guide)

Instructions:
The following thermodynamic and kinematic parameters, which can be computed via various hodograph and sounding analysis programs, have been shown to have particular ability in forecasting convective storm type. In certain situations, some of these parameters perform better than others. Match at least ONE relevant strength AND limitation description to EACH parameter. A description may have more than one relevant parameter that matches it. Note: Additional strengths and limitations of parameters can be found from the web site, " Capabilities of Thermodynamic and Kinematic Severe Weather Sounding Parameters" http://www.wdtb.noaa.gov/resources/IC/svrparams/svrparams.htm

Parameter (or value)		Strength or Limitation Description
A. 7.5 m/s off the (0-6 km) mean wind to right or left of mean shear vector	_____	Range of values from 20 to 100 m^2/s^2 indicate a preference for convective storms to develop low- level mesocyclones
B. Bulk Richardson Number (BRN)	_____	Important to consider for MCS longevity
C. Hodograph Length	_____	Requires an estimate of storm motion
D. 0-3 km Storm-Relative Helicity	_____	Increasing values from 1.0 to 3.0 and higher correspond to increasing probability of tornadic supercells
E. Positive Shear	_____	When combined with sufficient S-R low-level winds (and CAPE), 8-10 m/s at 500 mb is a lower bound threshold for discriminating tornadic supercells
F. Steep sub-cloud temperature lapse rate	_____	Can be used to estimate supercell motion
G. Hodograph Shape	_____	Must consider the effects of lifted parcel choice, vertical distribution and model characteristics for effective application

H. Energy-Helicity Index(EHI)

I. S-R midlevel winds

J. CAPE

K. Wet-Bulb Zero Height

L. BRN Shear

M. Mean Wind Vector

N. Low-level (0-1 km) shear

O. LCL height

P. Low-level (0-2.5 km) shear

Q. CIN

_____ Can provide estimate of rotation potential without an estimate of storm motion

_____ Enhances dry microburst potential

_____ Indicates increasing tornadic supercell potential with increasing magnitude, but does not work as well with non-supercell tornado potential

_____ Indicates supercells are likely when values are between 10 and 50

_____ Not useful for anticyclonic-curved hodographs

_____ A strong discriminator for significant tornadoes in supercells

______ Requires drawing mean shear vector on hodograph to estimate supercell motion

_____ The 1500 m AGL upper bound threshold applies only to supercells with significant (F2 or greater) tornadoes

_____ Assumes no mixing with the surrounding environment, and ignores effects of freezing and water loading

_____ Only partially predicts severe hail potential because it doesn't consider updraft strength or particle trajectory

____ Loses effectiveness in predicting storm type in extremely high (or low) CAPE situations

_____ Indicates potential for supercells if magnitude is $\geq$ 15-20 m/s over 0 to 6 km layer AGL.

_____ Not as important for forcing wet microbursts as it is for dry microbursts

______ Requires a qualitative assessment of the hodograph

______ Useful in forecasting ordinary cell motion

______ Very good at assessing midlevel rotational potential in thunderstorms

_______ Provides estimate of updraft strength

_______ Values from 7000 to 10,500 ft AGL indicate potential for severe hail

_______ In RKW theory, requires additional assessment of cold pool strength to estimate MCS longevity

_______ Propagation effects cause storms to deviate from this vector

_______ A mixed layer parcel is the best method to use this parameter to estimate cloud base; also good parameter for predicting significant tornado potential in supercells.

______ A factor in multicell storm propagation

______ Used as a good predictor for supercells but not tornadoes

_____ Most sensitive to vertical resolution in the models and AWIPS displays

_____ Quantifies the amount of work required to lift a parcel through an environmental layer that is warmer than the parcel

Part II. Shear and Buoyancy Relationships (from Lessons 1 and 2)

Instructions:
Please answer the following questions.

1. What special considerations do forecasters need to make when predicting severe storm type in cases of extreme instability and weak shear? What about cases of weak instability and extreme shear (which often occur during the cool season)? What combinations of parameters (if any) work well in these types of situations?

2. Briefly explain why it is important to use both kinematic and thermodynamic parameters to assess storm type? Discuss some ways concepts covered in this IC have changed your knowledge and/or techniques used in anticipating convective storm structure and potential evolution.

3. Briefly describe the effects of midlevel dry air on storm intensity and evolution.

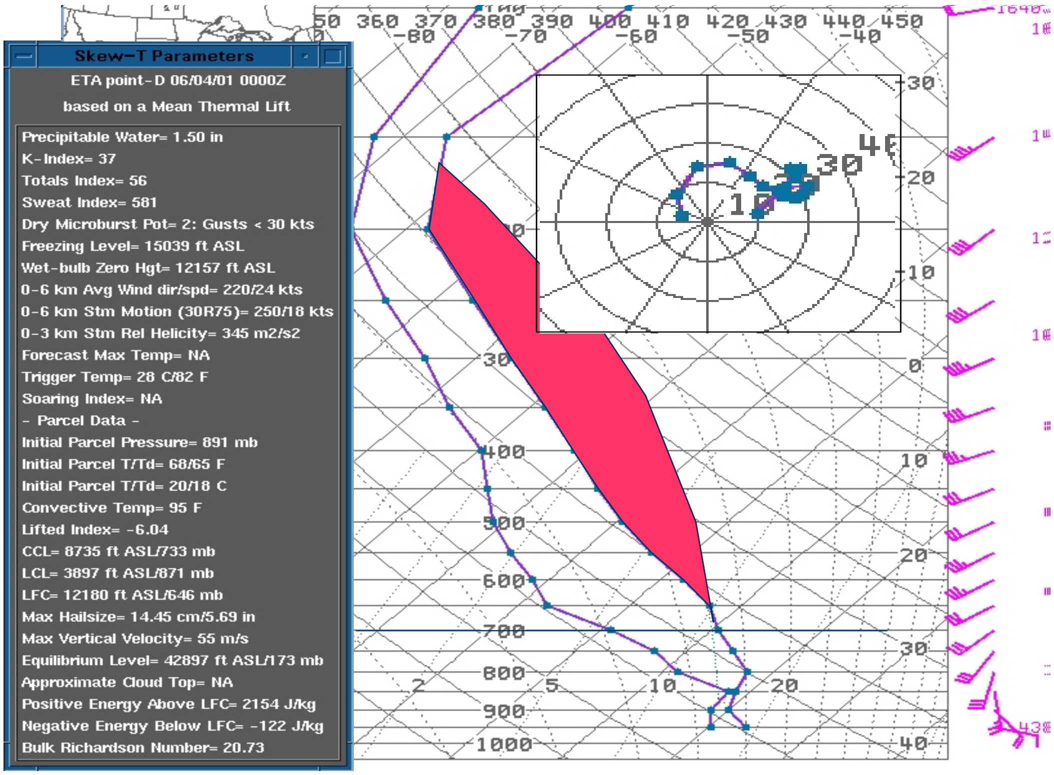
4. Choose the most accurate statement regarding the effects of midlevel dry air in thunderstorm environments characterized by large buoyancies. (note: assume there is ample lifting to produce convection)

A) the dry air will tend to weaken thunderstorm downdrafts
B) the dry air will weaken the cold pool
C) DCAPE is a good indicator of downdraft intensity
D) if the mean winds are weak, severe surface winds are most likely if a strong cold pool develops

5. Choose two accurate statements regarding the effects of shear depth on convective storms.

A) Based on observations, ambient shear in the lowest 1 to 2 km above the ground is strongest in tornadic supercells and long-lasting multicell systems.
B) Observations indicate shear in the 0 to 6 km layer above the ground is most critical in discriminating tornadic potential in supercells.
C) Numerical simulations in the early 1990s suggested that strong, shallow shear promoted longer-lived supercells.
D) Given sufficient instability, shear depth combined with storm motion can determine (to a large extent) the organizational mode of most storm types.

6. Yes or No. Splitting thunderstorms would be possible in the given environment (see sounding below). Please explain.



Part III. Production and Detection of Severe Weather (Lesson3)

Instructions:
Select the best answer to complete the statement.

1. The first onset of significant reflectivity in a updraft depends on when the updraft reaches:
   A) a height of 20, 000 ft or more
   B) the 500 mb pressure level
   C) -10 deg C to -20 deg C layer
   D) a 50 dBZ core

2. The most useful technique for inferring an updraft location for pulse storm is to observe the location of:

A) upper-level reflectivity core
B) storm-top divergence
C) low-level convergence
D) highest VIL

3. What are the characteristics of a weakly sheared ordinary thunderstorm in terms of environment, storm structure, and evolution?

A) 0-6 km mean shear of < 20 kts, vertical (no tilt) , and 30 min lifetime
B) 0-6 km mean shear of < 20 kts, sufficient CAPE, vertical (no tilt), and 30 min lifetime
C) 0-6 km mean shear of < 20 kts, suff. CAPE, 15-20 dBZ echoes into freezing layer,1 hr.
D) Updraft/downdraft co-located, sufficient CAPE, and storms moving with mean wind

4. List at least 3 characteristics of dry microbursts environments.

1) ________________
2) ________________
3) ________________

5. Describe the best ways to predict the motion of convective storms.

A) Ordinary cells

B) Supercells

C) Multicells

6. Briefly describe the effects of shear on storm propagation.

7. Identify 4 reflectivity characteristics of supercell storms.

8. Describe the most likely convective evolution given a long (> 20 m/s) , straight hodograph.

9. What are the two critical ingredients for non-supercell tornadoes?

10. Describe the criteria for determining an operator-defined mesocyclone.

11. Identify 3 characteristics of LP supercells.

12. Identify 3 characteristics of classic supercells.

13. Identify 3 characteristics of high precipitation supercells.

14. What is the primary distinguishing characteristic of mini supercells?

15. What are three major signatures for determining large hail in supercells?

16. What are the criteria for determining an operator-defined tornado vortex signature?

17. Describe 2 major meteorological factors that contribute to flash flooding in supercells and multicells.

18. Which type of MCS will typically move faster , trailing stratiform, leading stratiform, or parallel stratiform?

19. Factors affecting multicell storm propagation include ________________ (please identify at least 3).

20. Describe the evolution of bookend vortices in bow echoes.

21. Describe the inverse relationship between CAPE and shear in observed environments of squall lines and bow echoes.

22.   According to numerical simulations, which type of Rear-Inflow Jets (Descending or non-descending) tend to live longer?

23. Identify 3 signatures for high winds in multicells.

24. Identify the principal movement-related signature for producing heavy (potentially flash-flooding) rain.